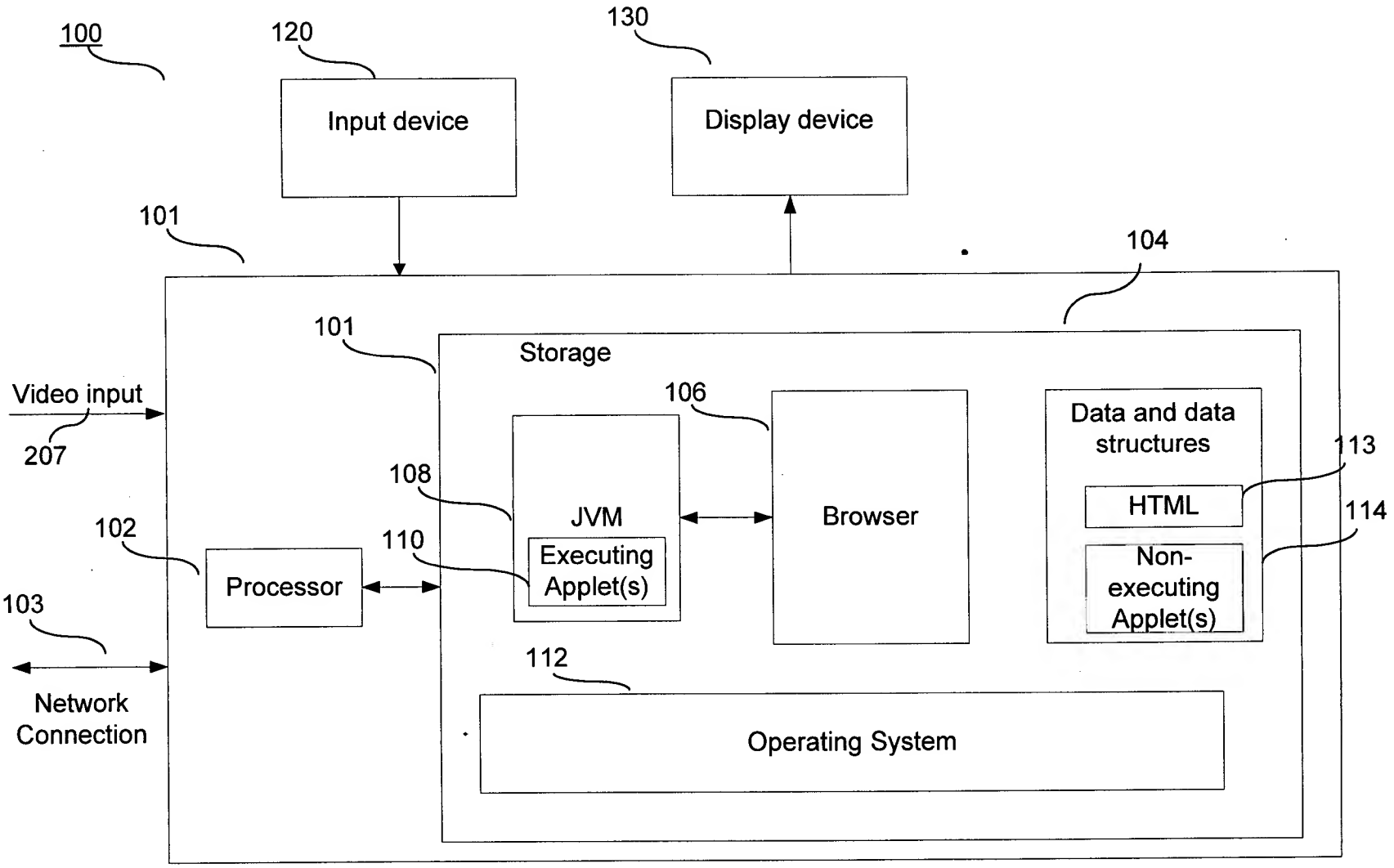
100
120
Input device
130
Display device
101
104
101
Storage
Video input
207
106
Data and data structures
113
108
JVM
Executing Applet(s)
Browser
HTML
114
102
110
Processor
Non-executing Applet(s)
103
112
Network Connection
Operating System

Fig. 1(a)

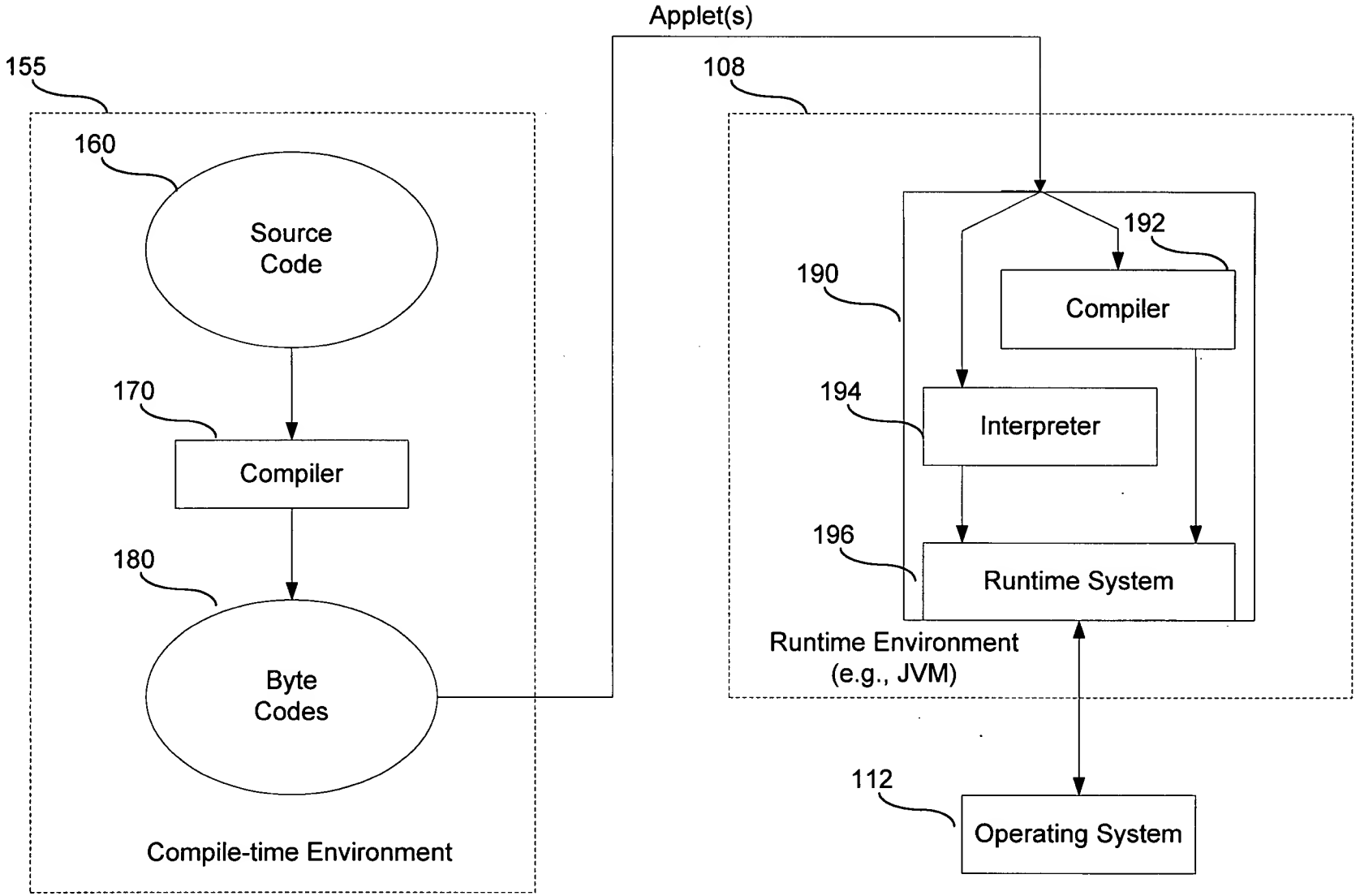
Applet(s)
155
108
160
Source Code
170
Compiler
180
Byte Codes
Compile-time Environment
192
190
Compiler
194
Interpreter
196
Runtime System
Runtime Environment (e.g., JVM)
112
Operating System

Fig. 1(b)

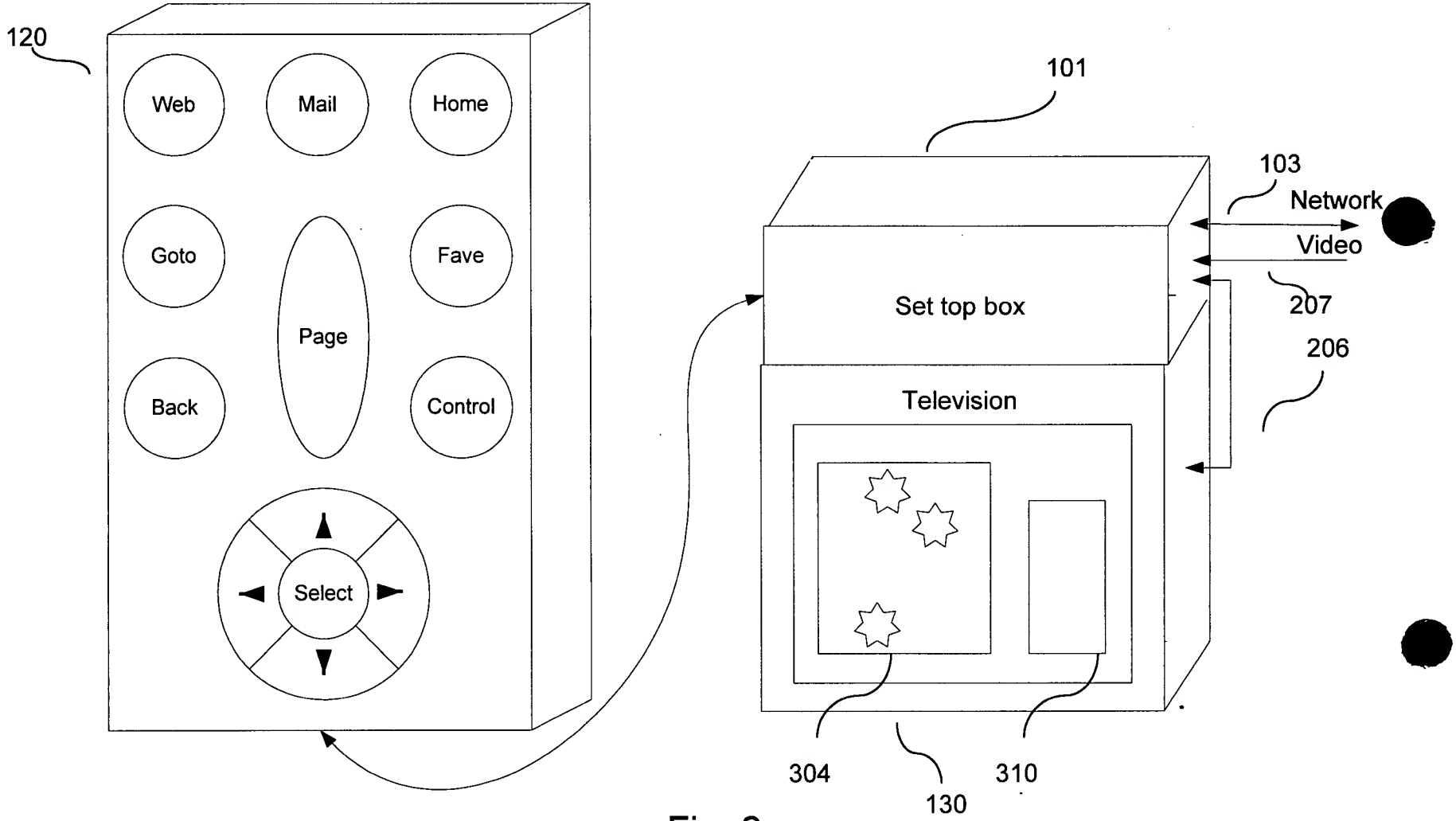

Fig. 2

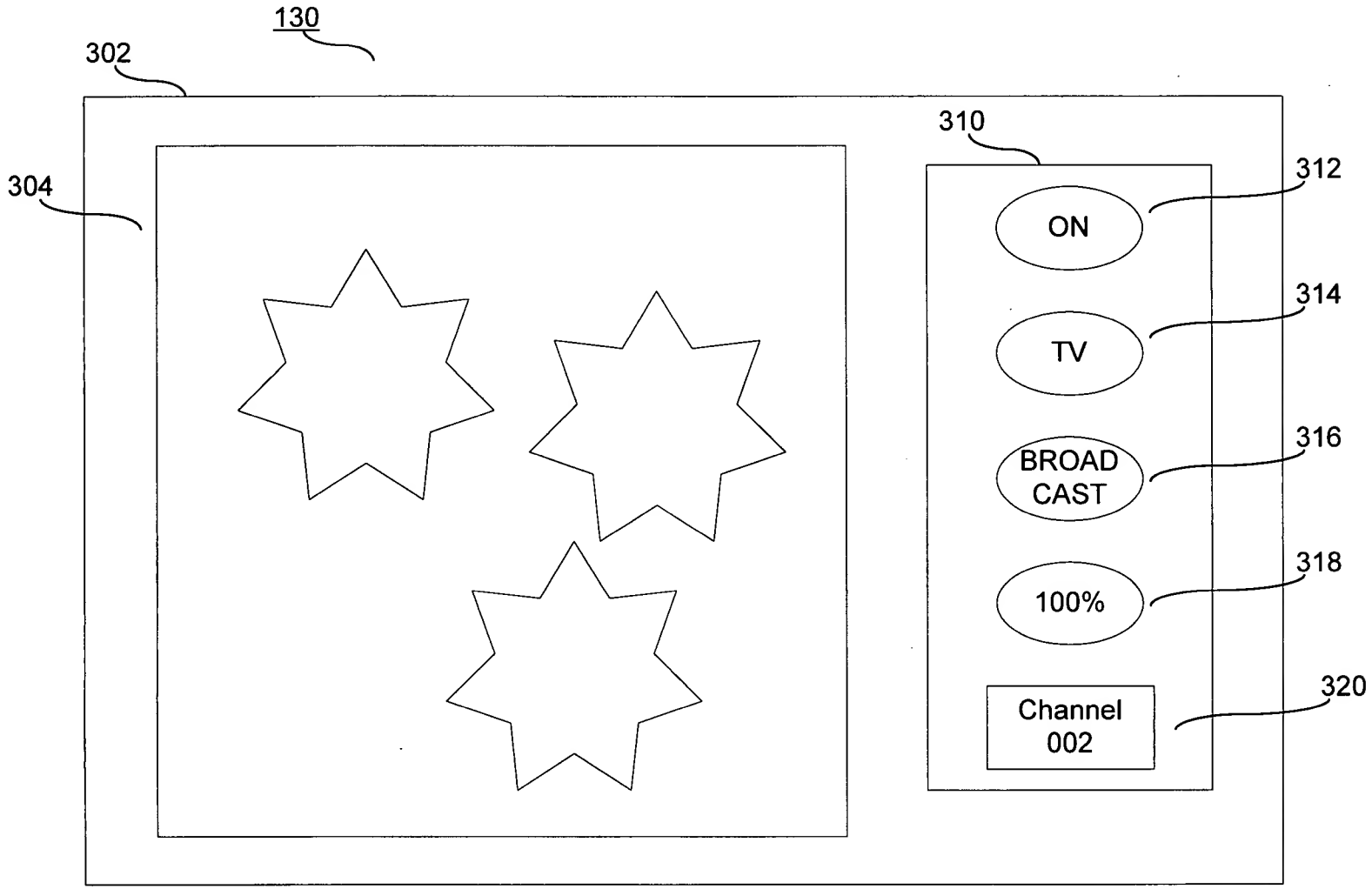

Fig. 3(a)
Example of a Web page with virtual controller and displayed video content

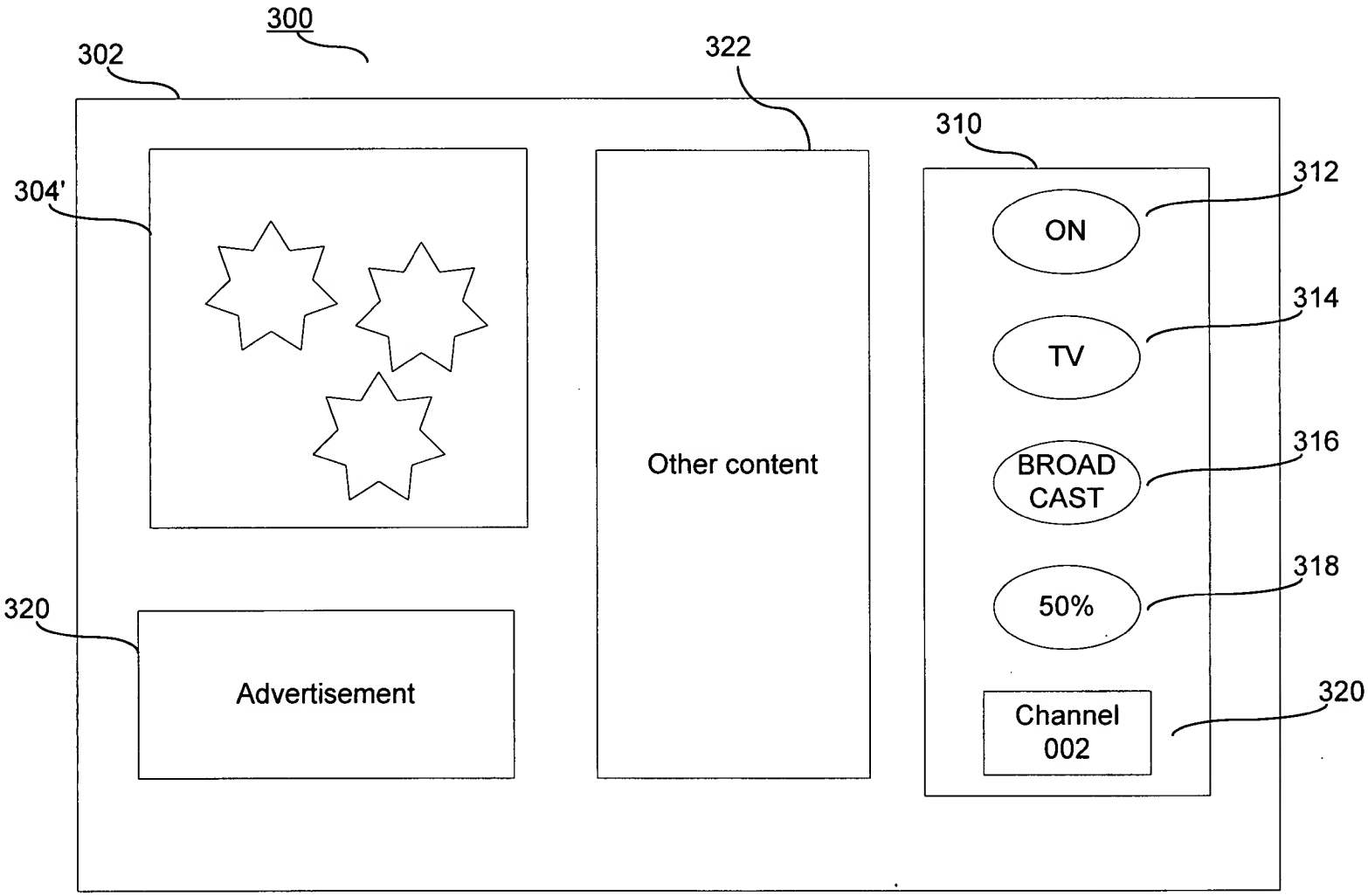

Fig. 3(b)
Example of a Web page with virtual controller and displayed video content

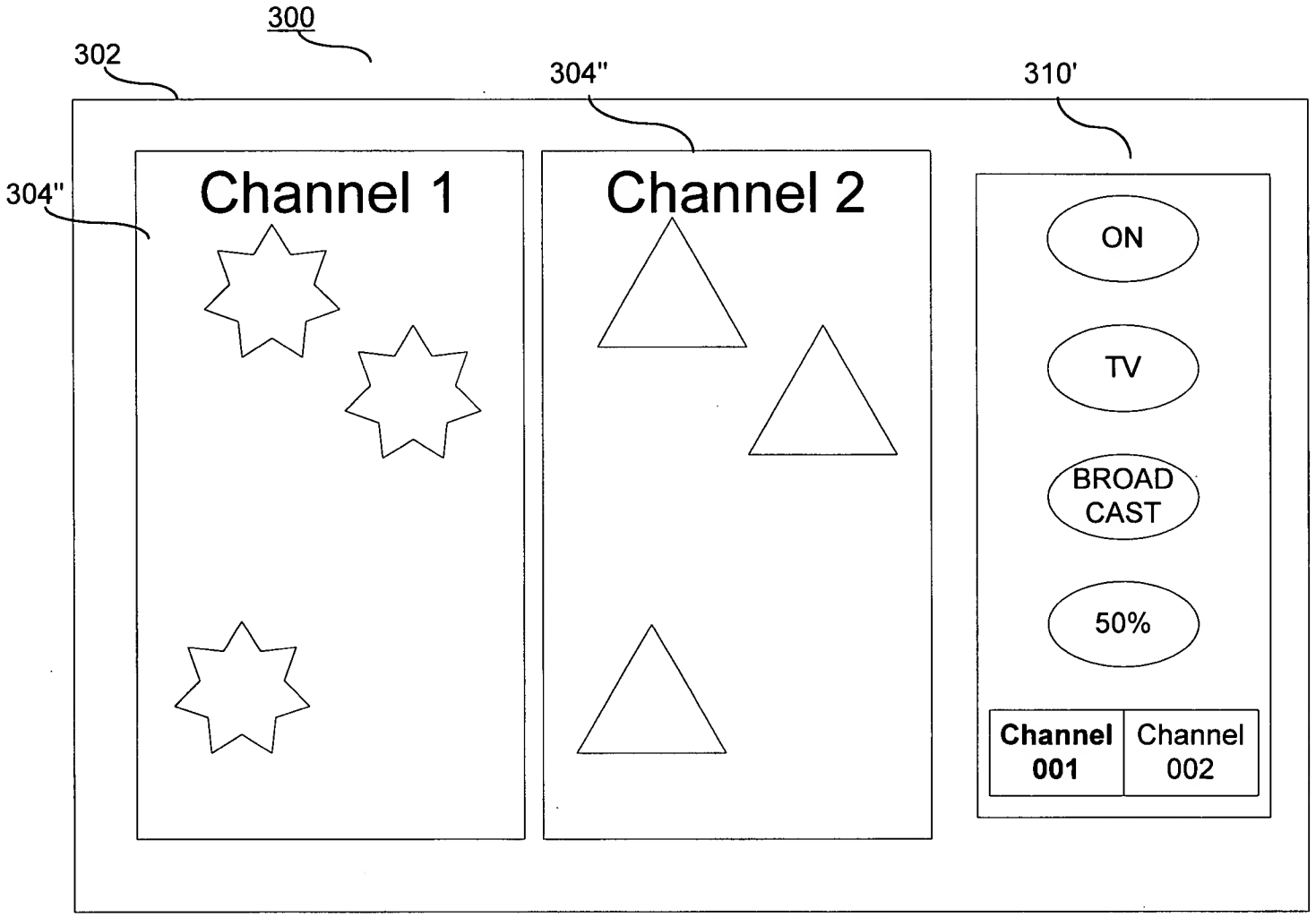

Fig. 3(c)
Example of a Web page with virtual controller and displayed video content

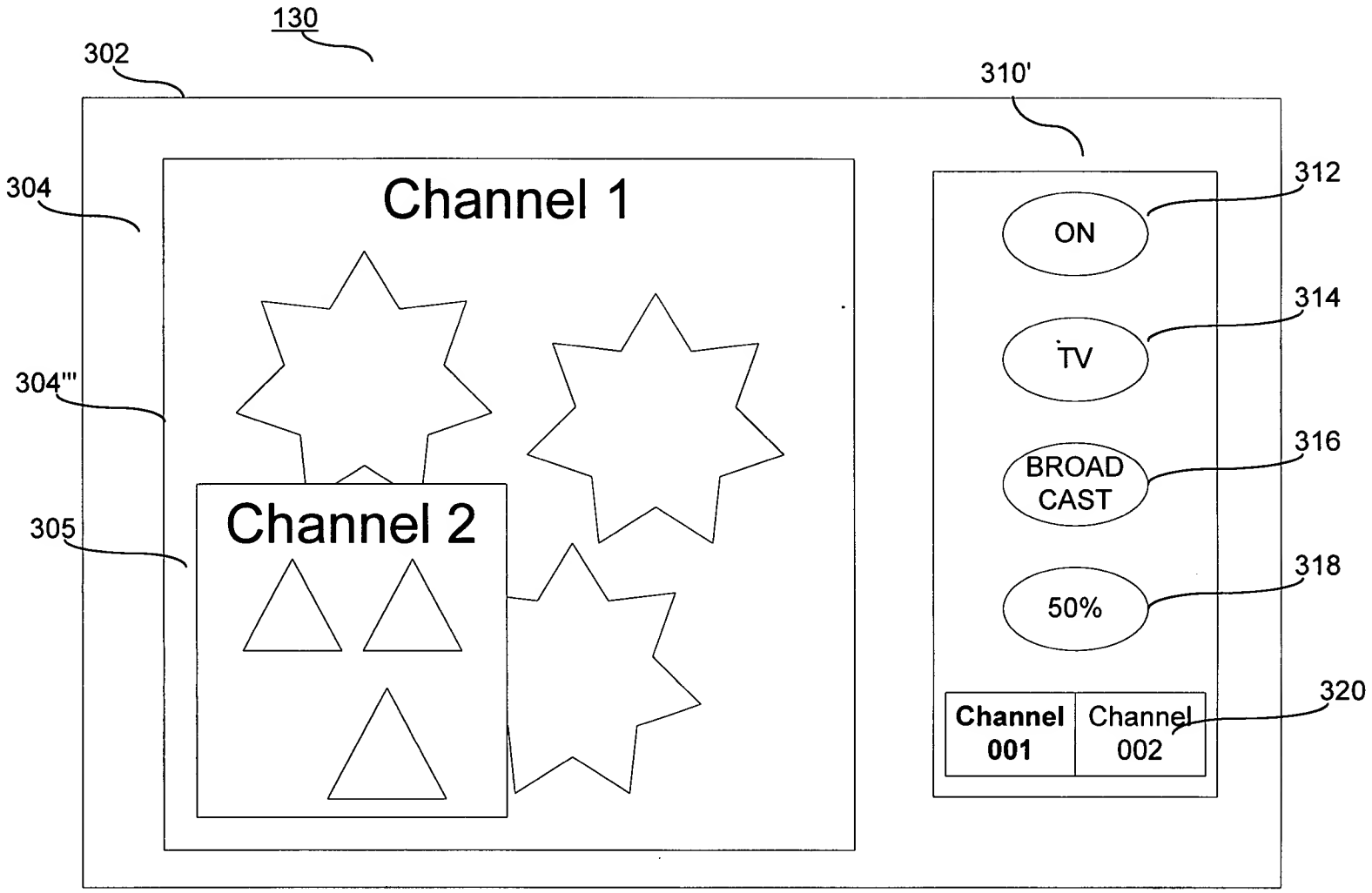

Fig. 3(d)
Example of a Web page with virtual controller and displayed video content

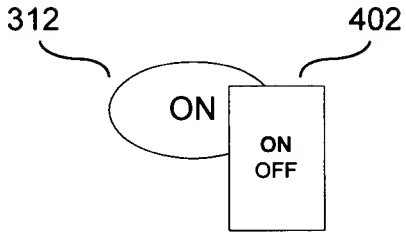

Fig. 4(a)

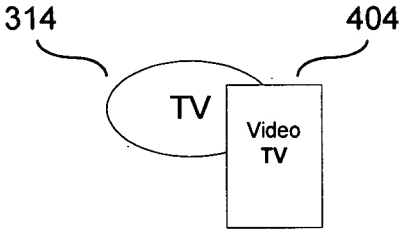

Fig. 4(b)

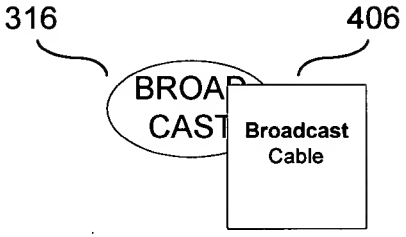

Fig. 4(c)

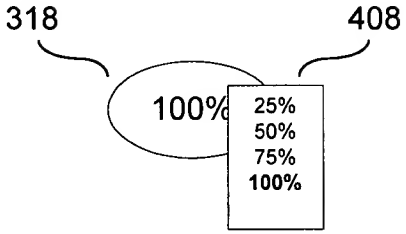

Fig. 4(d)

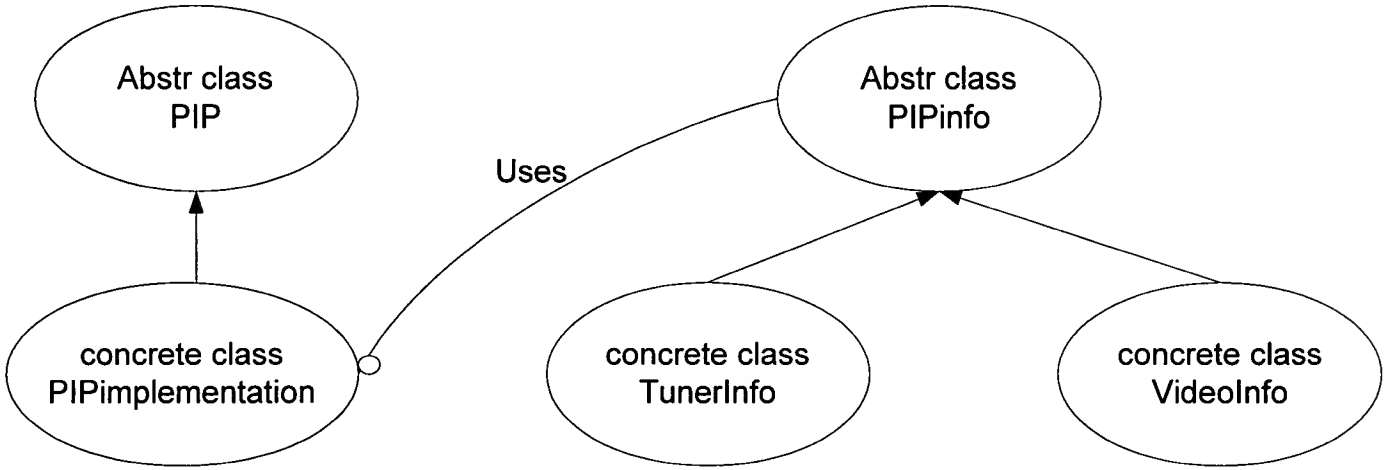

Fig. 5(a)

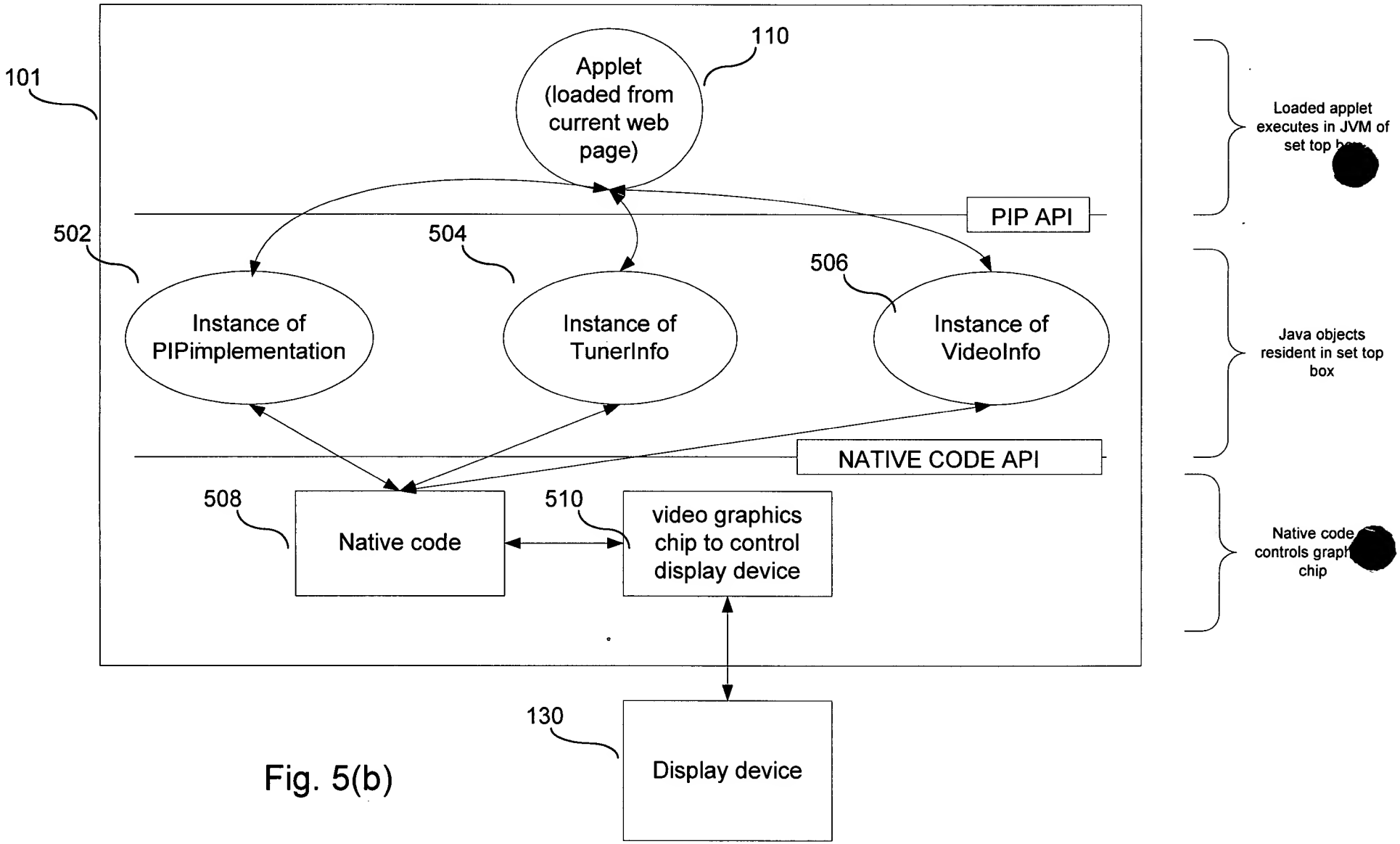
101
110
Applet (loaded from current web page)
PIP API
502
504
506
Instance of PIPimplementation
Instance of TunerInfo
Instance of VideoInfo
NATIVE CODE API
508
510
Native code
video graphics chip to control display device
130
Display device
Loaded applet executes in JVM of set top box
Java objects resident in set top box
Native code controls graphics chip

Fig. 5(b)

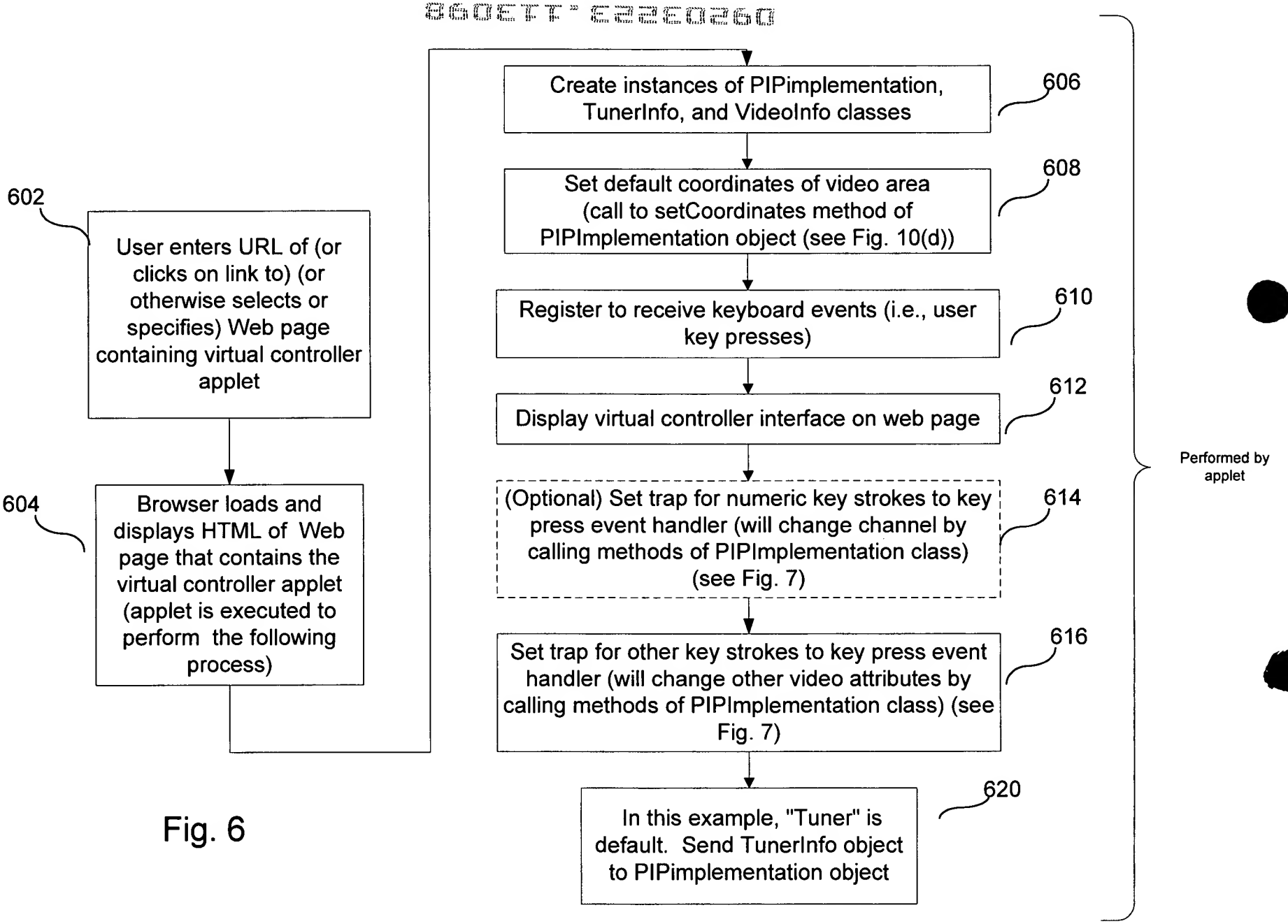
602
User enters URL of (or clicks on link to) (or otherwise selects or specifies) Web page containing virtual controller applet
604
Browser loads and displays HTML of Web page that contains the virtual controller applet (applet is executed to perform the following process)
Create instances of PIPimplementation, TunerInfo, and VideoInfo classes
606
Set default coordinates of video area (call to setCoordinates method of PIPImplementation object (see Fig. 10(d))
608
Register to receive keyboard events (i.e., user key presses)
610
Display virtual controller interface on web page
612
(Optional) Set trap for numeric key strokes to key press event handler (will change channel by calling methods of PIPImplementation class) (see Fig. 7)
614
Set trap for other key strokes to key press event handler (will change other video attributes by calling methods of PIPImplementation class) (see Fig. 7)
616
In this example, "Tuner" is default. Send TunerInfo object to PIPimplementation object
620
Performed by applet

Fig. 6

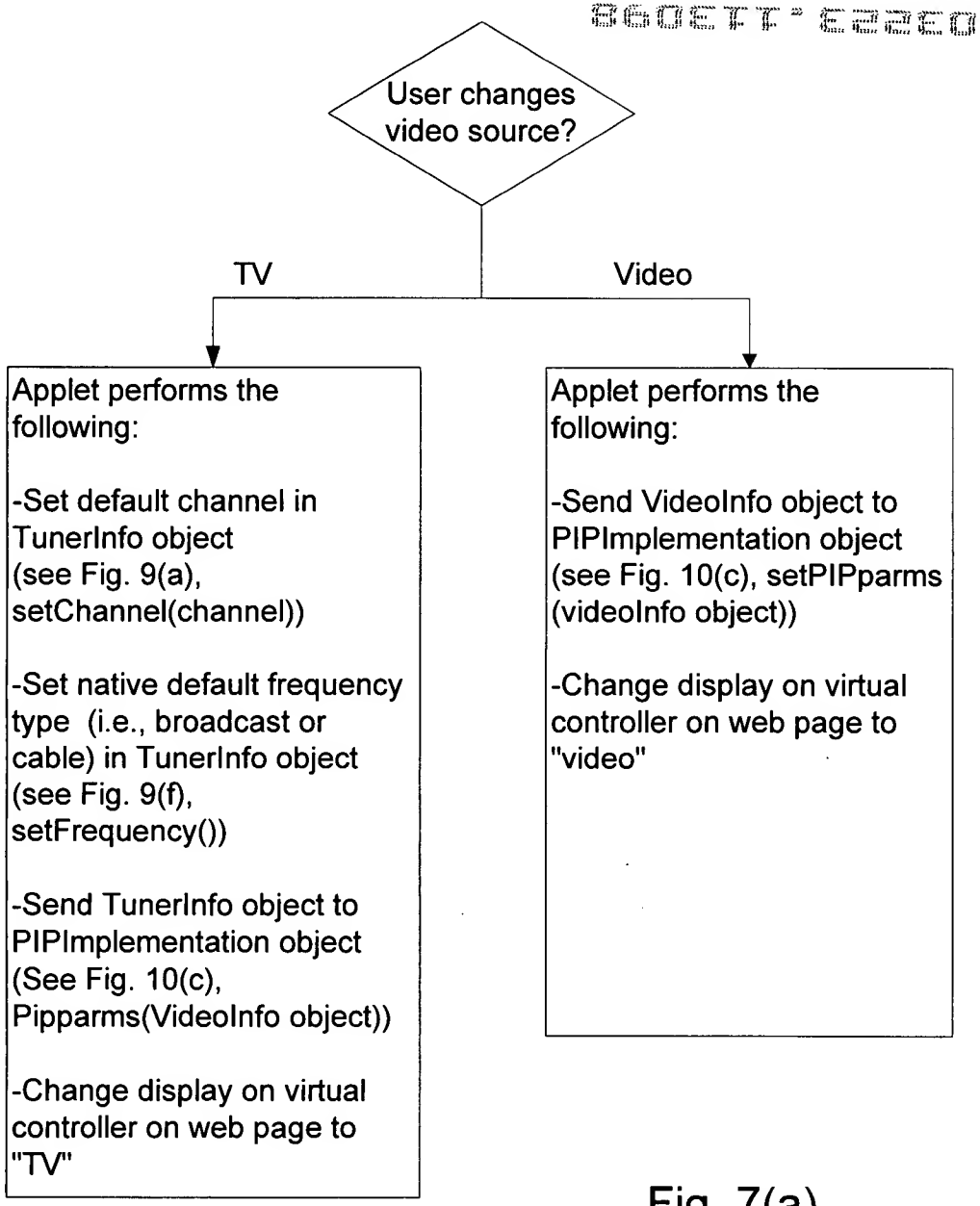
User changes video source?
TV
Video
Applet performs the following:
-Set default channel in TunerInfo object (see Fig. 9(a), setChannel(channel))
-Set native default frequency type (i.e., broadcast or cable) in TunerInfo object (see Fig. 9(f), setFrequency())
-Send TunerInfo object to PIPImplementation object (See Fig. 10(c), Pipparms(VideoInfo object))
-Change display on virtual controller on web page to "TV"
Applet performs the following:
-Send VideoInfo object to PIPImplementation object (see Fig. 10(c), setPIPparms (videoInfo object))
-Change display on virtual controller on web page to "video"

Fig. 7(a)

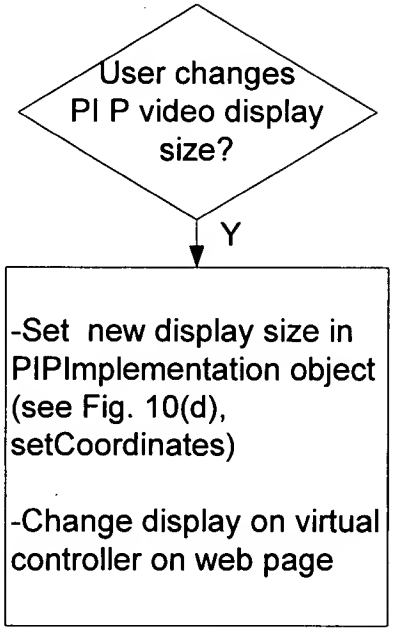
User changes PI P video display size?
Y
-Set new display size in PIPImplementation object (see Fig. 10(d), setCoordinates)
-Change display on virtual controller on web page

Fig. 7(b)

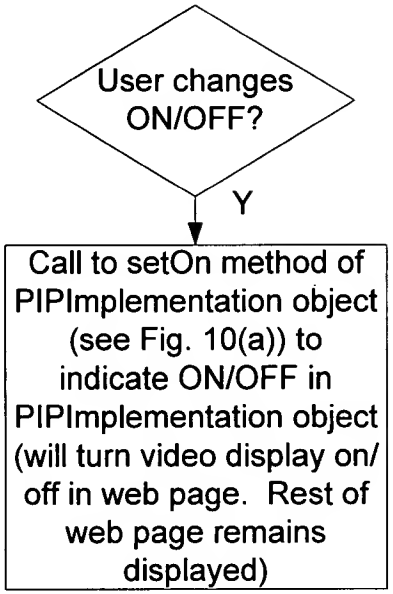

Fig. 7(c)

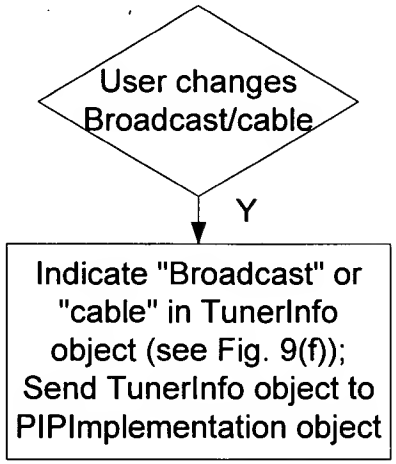

Fig. 7(d)

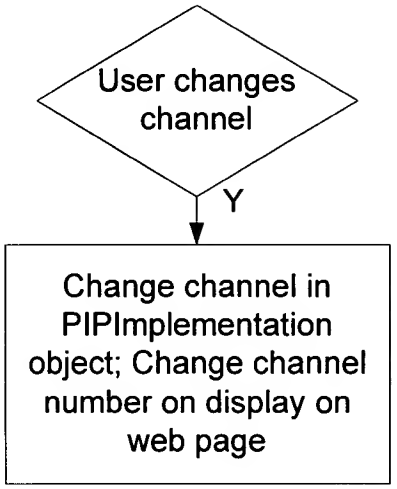

Fig. 7(e)

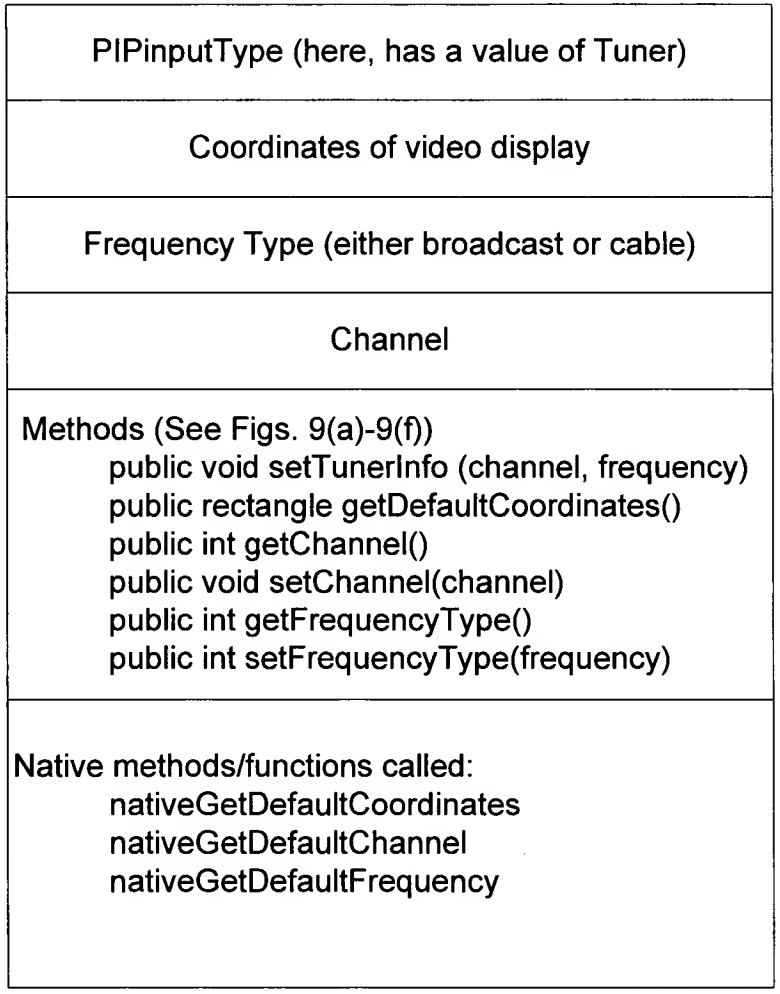

Fig. 8(a)
Example TunerInfo object

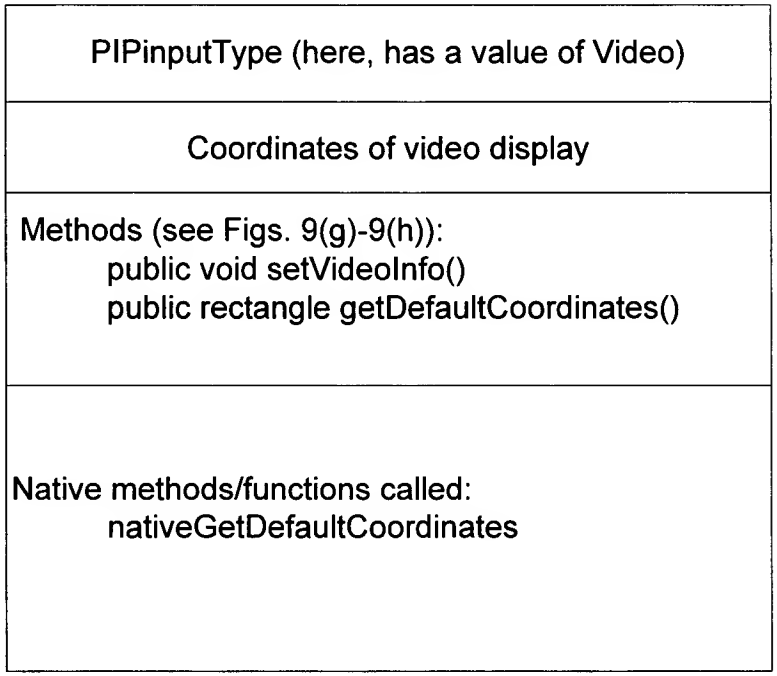

Fig. 8(b)
Example VideoInfo object

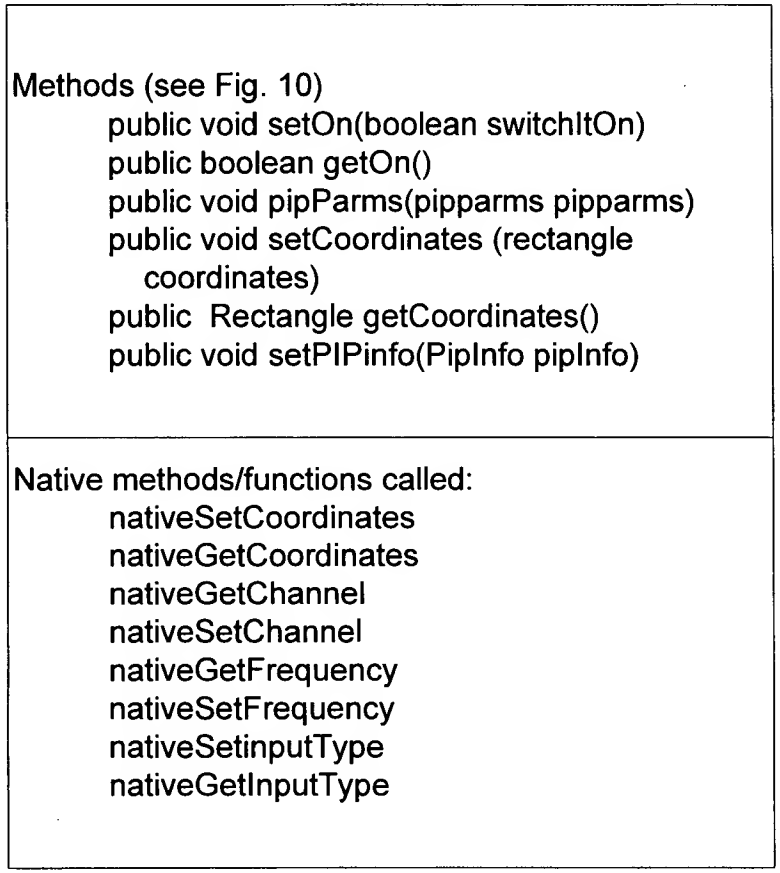

Fig. 8(c)
Example PIPImplementation object

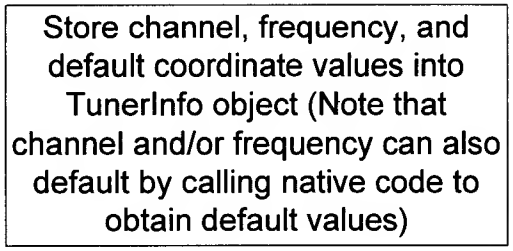

Fig. 9(a)
public void setTunerInfo(channel, frequency)

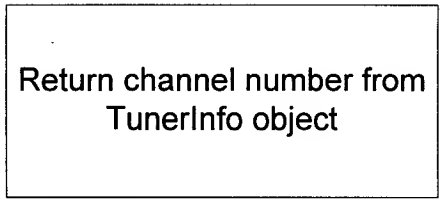

Fig. 9(c)
public int getChannel()

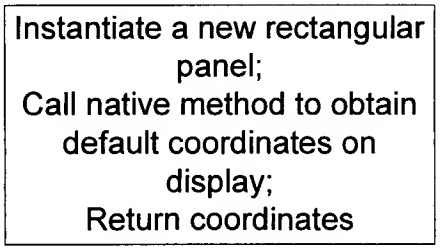

Fig. 9(b)
public rectangle getDefault Coordinates()

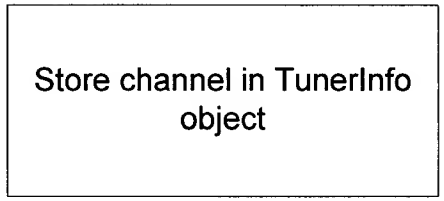

Fig. 9(d)
public void setChannel(channel)

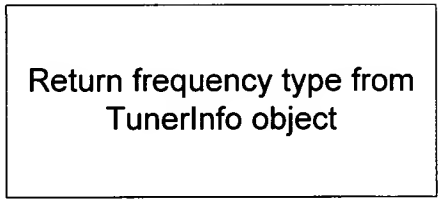

Fig. 9(e)
public int getFrequencyType()

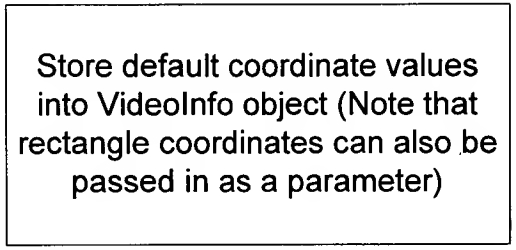

Fig. 9(g)
public void setVideoInfo()

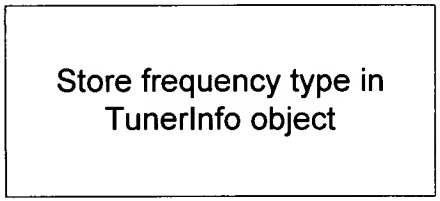

Fig. 9(f)
public void setFrequencyType(frequency)

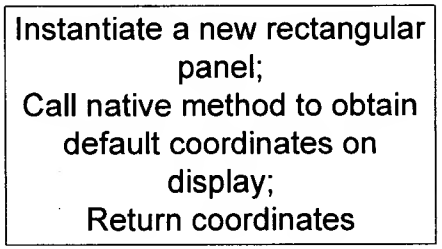

Fig. 9(h)
public rectangle getDefault Coordinates()

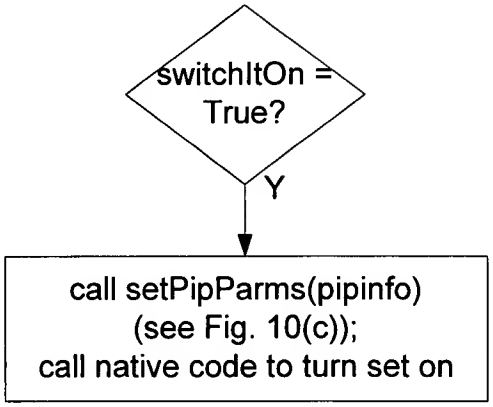

Fig 10(a)
public void setOn(boolean switchItOn)

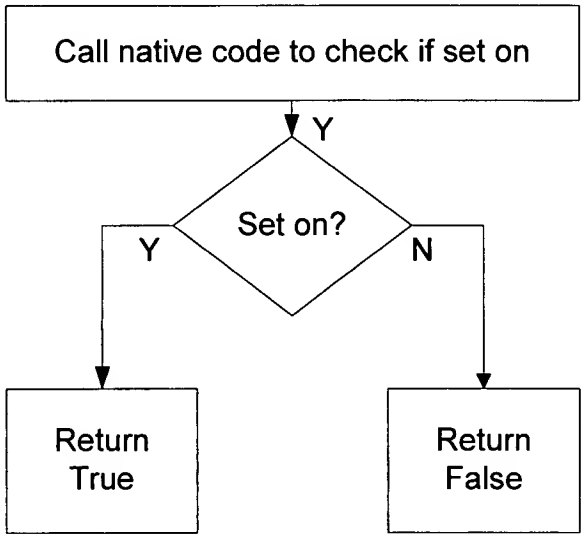

Fig 10(b)
public boolean getOn()

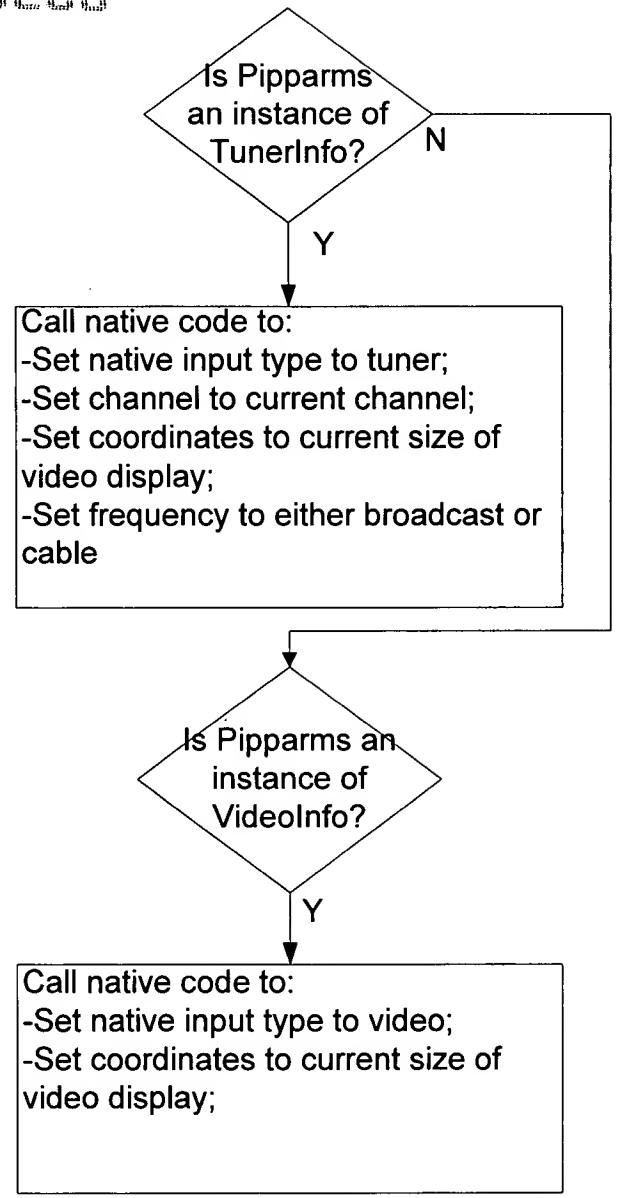

Fig 10(c)
public void pipParms(pipparms pipparms)

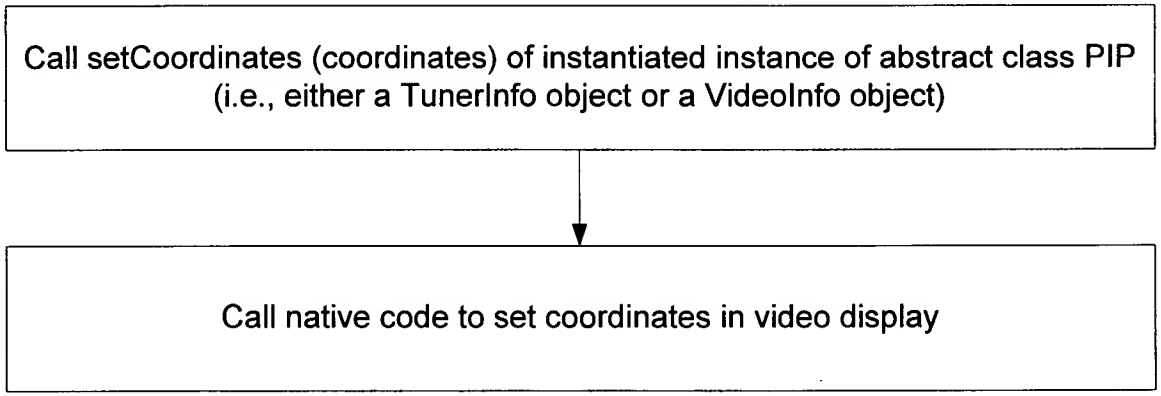

Fig. 10(d)
public void setCoordinates (rectangle coordinates)

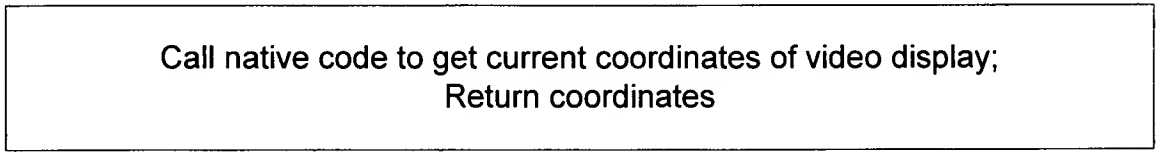

Fig. 10(e)
public Rectangle getCoordinates ()

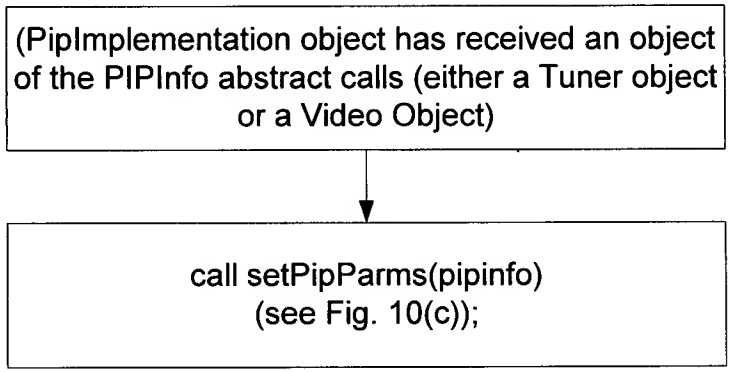

Fig. 10(f)
public void setPIPInfo(pipInfo pipInfo)

```
private native void nativeSetOn(boolean onOrOff);
private native int nativeGetOn();

private static native void nativeSetCoordinates(Rectangle rect);
private static native void nativeGetCoordinates(Rectangle rect);

private static native int nativeGetChannel();
private static native int nativeSetChannel(int channel);
private static native int nativeGetFrequency();
private static native void nativeSetFrequency(int frequency);

private static native void nativeSetInputType(int videoOrTuner);
private static native void nativeGetInputType();

private static native void nativeGetDefaultCoordinates (Rectangle rect);
private static native int nativeGetDefaultChannel();
private static native int nativeGetDefaultFrequency();
```

Fig. 11
Native code API

1202

```
<title>Virtual video controller</title>
<body bgcolor=000000 text=cc000 link=ffffff vlink=ffffff alink=ffffff>
<applet code=virtualcontrollerapplet ALIGN=right width=100 hieght=300 vspace=20>
</applet>
```

Fig. 12
Example HTML for a Web Page
containing virtual controller applet